CHAPTER 21A - MISHAP INVESTIGATION

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21A.1 PURPOSE

This chapter complements NPR 8621.1, "NASA Procedural Requirements for Mishap Reporting, Investigating, and Recordkeeping", by providing additional details on mishaps and close calls to determine their causes, implement corrective actions, document and disseminate lessons learned for the purpose of mishap prevention.

21A.2 APPLICABILITY

The provisions of this chapter are applicable to Glenn Research Center (GRC) which includes Plum Brook Station.

21A.3 AUTHORITY

The authority for this chapter derives from NPR 8715.3, "NASA Safety Manual," and NPR 8621.1, "NASA Procedural Requirements for Mishap Reporting, Investigating, and Recordkeeping".

21A.4 POLICY/PROCEDURES

GRC's policy requires that employees promptly report any mishap that occurs, including fire; explosion; natural disaster; equipment or test failure; plant, vehicle, or aircraft accident; environmental, close calls, or other incident. When a mishap is reported, the procedures specified herein are to be followed for responding to the emergency, securing the mishap area, and initiating a reporting sequence to Center and NASA Headquarters personnel as required depending on the type of mishap. These procedures inform GRC's employees, contractors, and visitors about emergency notification, mishap investigation

that may occur during GRC's operations, and those mishaps which involve NASA or contractor personnel, the public, and/or NASA property.

21A.5 DEFINITIONS

NASA MISHAP

An unplanned event that results in at least one of the following:

a. Injury to non-NASA personnel, caused by NASA operations.
b. Damage to public or private property (including foreign property), caused by NASA operations or NASA funded development or research projects.
c. Occupational injury or occupational illness to NASA personnel.
d. NASA mission failure.
e. Destruction of, or damage to, NASA property except for a malfunction or failure of component parts that are normally subject to fair wear and tear and have a fixed useful life that is less than the fixed useful life of the complete system or unit of equipment, provided that the following are true:
    1. There was adequate preventative maintenance; and
    2. The malfunction or failure was the only damage and the sole action is to replace or repair that component.

TYPE A MISHAP

A mishap resulting in one or more of the following: (1) an occupational injury or illness resulting in a fatality, a permanent total disability, or the hospitalization for inpatient care of 3 or more people within 30 workdays of the mishap; (2) a total direct cost of mission failure and property damage of $1 million or more; (3) a crewed aircraft hull loss; (4) an occurrence of an unexpected aircraft departure from controlled flight.

TYPE B MISHAP

A mishap that caused an occupational injury or illness that resulted in a permanent partial disability, the hospitalization for inpatient care of 1-2 people within 30 workdays of the mishap, or a total direct cost of mission failure and property damage of at least $250,000 but less than $1,000,000.

TYPE C MISHAP

A mishap resulting in a nonfatal occupational injury or illness that caused any days away from work, restricted duty, or transfer to another job beyond the day or shift on which it occurred, or a total direct cost of mission failure and property damage of at least $25,000 but less than $250,000.

TYPE D MISHAP

A mishap that caused any nonfatal OSHA recordable occupational injury and/or illness that does not meet the definition of a Type C mishap, or a total direct cost of mission failure and property damage of at least $1,000 but less than $25,000.

CLOSE CALL

An occurrence or a condition of employee concern in which there is no injury or only minor injury requiring first aid and no significant equipment/property damage/mission failure (less than $1,000) but which possesses a potential to cause a mishap.

TEST FAILURE

Unexpected damage of research hardware this includes support test hardware or instrumentation but no significant test facility damage. Test facility can be minor (e.g., combustor line erosion), in which case they are to be reported through run reports, or they can be significant (e.g., combustor lines burnout) in which case damage is to be reported directly to the Chief of GSO.

MISSION FAILURE

A mishap of whatever intrinsic severity that in the judgment of the Enter price Associate Administrator and the Associate Administrator for Safety and Mission Assurance , prevents the achievement of primary NASA mission objectives as described in the mission operations report or equivalent document.

NASA CONTRACTOR OR GRANTEE MISHAP OR CLOSE CALL

Any mishap that a NASA contractor/grantee is required to report or investigate due to the provisions of its contract.

WITNESS

A person who has information, evidence, or proof about a mishap and provides his/her knowledge of the facts to the investigating authority.

WITNESS STATEMENTS

A verbal or written statement from a witness that describes his/her account including a description of the sequence of events, facts, conditions, and/or causes of the mishap, which is considered privileged and is only releasable to the investigating authority and not the public or other government agencies unless release is ordered by a court of law.

DIRECT COST of MISHAP or CLOSE CALL

(For the purpose of mishap classification). The sum of the costs (the grater value of actual or fair market value) of damaged property, destroyed property, or mission failure, actual cost of repair or replacement, labor (actual value of replacement or repair hours for internal and external/contracted labor), cost of the lost commodity (e.g., the cost of fluid that was lost from a ruptured pressure vessel, as well as resultant costs such as environmental decontamination, property cleanup, and restoration, or the best official estimate of these costs.

MISHAP INVESTIGATION TEAM (MIT)

A NASA-sponsored team that:

a. Is appointed by the Center Director, Director of Safety and Mission Assurance, Chief of Safety, or designee, for a Type C mishap, Type D mishap, or close call.
b. Consists of an odd number of Federal employees (including the chairperson) where the majority of the members are independent from the operation or activity in which the mishap occurred. (The actual number of members is chosen at the discretion of the appointing official.)
c. Includes a safety officer and a human factors mishap investigator as members.
d. Is tasked to investigate the mishap or close call and generate the mishap report per the requirements specified in the NPR.

MISHAP INVESTIGATOR (MI)

A Federal employee who has expertise and experience in mishap or close call investigation; has knowledge of human error analysis in mishaps; serves as the sole investigator for a Type C mishap, Type D mishap, or close call; and is tasked to investigate the mishap or close call and generate the mishap report per this NPR 8621.1.

APPOINTING OFFICIAL

The official with the responsibility to perform the following:

a. Determine the level of investigation, the type of investigation and MIT membership.
b. Accept the MIT's report as fulfilling the requirements of the investigation.
c. Ensure closure of approved corrective actions.
d. Is authorized to appoint an independent single investigator or Mishap Team.
e. The Appointing Official may have management responsibility over all organizations, which are likely to take corrective action as a result of the mishap.

f. The one person wholly responsible for the independent investigation process.
g. Responsible for appointing an independent Mishap Team/Independent Investigator.
h. Providing administrative and logistical support to the Mishap Team/Independent Investigator.
i. Accepting the Mishap Team/Independent Investigator findings, directing the responsible organization to develop a Corrective Action Plan, approving the Corrective Action Plan, tracking and closing corrective actions, and producing a summary report of all mishap related activities upon completion.

CORRECTIVE ACTIONS

Changes to design processes, work instructions, workmanship practices, training, inspections, tests, procedures, specifications, drawings, tools, equipment, facilities, resources, or material that result in methods that will prevent, minimize, or limit the potential for recurrence of a mishap.

LESSONS LEARNED

Knowledge or understanding gained by experience. The experience may be positive, as in a successful test or mission, or negative, as in a mishap of failure. Successes are also considered sources of lessons learned. A Lesson Learned must be significant in that is has real or assumed impact on operations; valid in that it is factually and technically correct; and applicable in that it identifies a specific design, process, or decision that reduces or eliminates the potential for failures and mishaps, or reinforces a positive result.

21A.6 RESPONSIBILITIES

Glenn Employees

a. Promptly report mishaps. Refer to Chapter 21 “Reporting Injuries Illnesses and Close Calls.”
b. If you are a witness to the scene of a mishap, you may be asked by the Glenn Safety Office to write a brief statement.

Glenn Supervisors

a. Identify the potential witnesses and get statements from them.
b. Secure the mishap scene and protect it from being disturbed.
c. Safeguard evidence such as samples and photographs.
d. Secure all records such a checklists, videos, and electronic data as requested.
e. If an accident/mishap, injury, illness, or close call occurs, it must be reported immediately to the GSO. An Incident Report Form must be fill

out and submit within 24hours to GSO. Refer to Chapter 21 "Reporting Injuries/Illnesses and Close Calls" for instructions.

f. Take necessary actions to correct hazards discovered during the investigation.
g. This includes temporary measures to protect the employees while waiting on a final report.
h. Turn in work requests if required building or equipment changes.
i. Improve on corrective action periodically.
j. If you are not a member of the team, support the mishap investigation teams as necessary.
k. Remind employees that reporting close calls and mishaps is necessary.
l. Review mishap information. Tell employees what was learned from the analysis and what actions plan will be taken.

Building Managers

a. Make sure mishaps that occur in your facility are reported and investigated.
b. If assigned by the appointing official investigate Type C, Type D, and close calls.
c. Support mishap investigations as necessary.
d. Make sure that employees in your facility know about corrective action plans and Lessons learned from incidents in your buildings.

Organizational Director

a. Review final reports and corrective action plans for mishaps that occur in your directorate.
b. Help to make sure the mishap reports are closed in a timely manner.
c. Provide services from your directorate that other GRC organizations need to correct hazards found during investigations such as testing, evaluating data, modifying buildings or equipment, or sampling work areas.

Chief, Glenn Safety Office (GSO)

a. Serve as the Center’s focal point for receiving all oral and written mishap reports and notifying the NASA Safety and Risk Management Division (Code QS) at NASA Headquarters of such incidents in a timely manner.
b. Verify that the policies and procedures for reporting, investigating and documenting mishaps and taking corrective action are implemented by line management.
c. Provide GRC with a list of personnel trained in mishap investigations.
d. Determine the type of investigation required and who will be involved in the investigation of a mishap.
e. Review and approve mishap reports and corrective actions.
f. Evaluate mishap reports for possible Lessons Learned.

g. Verify that corrective actions are completed.
h. Perform trend analysis and other statistical analyses of mishaps and close calls.
i. Review mishap data and make recommendations to line manager's on ways they can improve their safety and health performance within their organization.

Administrator, Glenn Safety Office

a. Receive the information from the Incident Report Form that was entered into the Incident Reporting Information System (IRIS) database to record the mishap. The database will automatically assign a case number to the Incident Report Form.
b. Receive and review the Incident Report Form and check for errors or omissions and return it to the submitter for further information if needed.

Occupational Medicine Services (OMS)

a. Provide the medical or pathological information required to fulfill the requirements of this chapter under the Privacy Act of 1974.
b. Responsible for providing any necessary occupational health and industrial hygiene support required by other GRC organizations to fulfill any of the responsibilities of this chapter.
c. Retain medical reports in a confidential/privileged file so that an inadvertent release is prevented.
d. Inform the employee's supervisor and the Chief, GSO immediately of a fatality or of a suspected disabling injury or illness.
e. Fill out an Incident Report Form when an employee has an injury or illness on the job. Submit the Incident Report Form on IRIS to GSO. The Incident Report Form will be e-mailed to the supervisor and GSO.

Safety, Health and Environmental Safety Board (SHEB)

All Type C and sometimes Type D mishap investigations will be reviewed and approved by the Safety, Health and Environmental Board. If the SHEB does not agree with the findings, the investigation team will re-review the incident data, reports and revise the report. If the SHEB approves the report the team may continue the investigation process and apply correction actions.

Security Management and Safeguards Office (SMSO)

a. Make sure that mishap scenes are secured.
b. Make sure that evidence and relevant information are preserved for the investigation.

Office of Chief Counsel

a. Develop and maintain a process for protecting the privileged status of witness statements, witness testimony, or other matters related to a mishap.
b. Make sure that all Team appointments for GRC meet legal requirements. Review mishap information or reports before they are released from GRC control to make sure the facts are correct and can be released.

Community and Media Relations Office

a. Prepare releases of any mishap information to the news media or other organizations outside GRC.
b. Have the GRC Office of Chief Counsel and anyone else connected with the mishap, such as the mishap investigation Team chairperson, review information to make sure that the facts are correct and can be released to the public.
c. Protect the privileged status of witness statements, witness testimony, and other matters related to a mishap under the Office of Chief Counsel ground rules.
d. Follow the procedures for public announcements by NASA found in agreements with other agencies or contractors when releasing mishap information.
e. Coordinate information releases as described in the NPR 8621 "NASA Procedures and Guidelines for Mishap Reporting, Investigating, and Recordkeeping.

Contracting Officers Technical Representatives (COTR)

a. Must ensure that GRC contractors understand and follow NASA and GRC contract requirements for investigating close calls and mishaps.
b. Immediately notify the Chief, GSO of all mishaps, incidents, or close calls involving contractors under his/her authority.
c. Ensure that it is properly completed and returned in a timely manner.
d. Provide for the contractors, as needed, training in proper investigative techniques and in procedures for completing the Incident Report Form.
e. Initiate corrective actions required abating any hazardous conditions or actions.
f. Assist in a mishap investigation as required by the GSO, or any board or Committee assembled to investigate the mishap or close calls.

Contractors

Contractors are responsible for notifying GSO and inputting data into IRIS of the occurrence of any mishap within 1 working day, including a close call that occurs during operations on the Center.

Contractors are responsible for investigating the mishap or close calls, as directed by the Contracting Officer Technical Representative (COTR), and reporting the results of the investigation to the COTR.

Independent Investigation

If the Appointing Official decides that an independent investigation is required and a single investigator acceptable, he/she will select a single independent investigator. The Independent Investigator will investigate the mishap using similar techniques as a multi-person Mishap Team.

21A.7 Emergency Notification and Response

The initial response by personnel in the area when a mishap occurs is very critical. The first priority is to get help. This should be accomplished immediately, even before initial rescue actions are attempted. Employees must call someone first and, if necessary, wait for properly trained and equipped rescue personnel. When a mishap occurs creating an emergency situation, the person or persons observing the event should use NASA phones to call 911 or pull the nearest manual fire alarm box, or call 216 433-8888 from a cell phone. Plum Brook employees should call 419 621-3222.

21A.8 MISHAP INVESTIGATION

Purposes of Mishap Investigations

The primary purpose of a mishap investigation and subsequent pursuit of corrective action is to prevent similar occurrences and thus improve the safety of NASA operations. The emphasis for a mishap investigation should be on discovering root cause-effect relationships from which remedial and corrective actions can be derived. The intent is not to place blame but to determine how processes and responsibilities may be clarified and improved and errors eliminated. Additional purposes for investigations are to determine the nature and extent of the event and its programmatic impact; to assist in the improvement of policies, standards, and regulations.

Investigating Mishaps

The investigation should be started as soon as the emergency is brought under control. The Glenn Safety Office may be a good source for help. The First Responder on the scene will take all initial information and send it to the Glenn Safety Office. In addition, a (n) Safety Specialist/Engineer from GSO may already be on the way to the scene. The

Center Director, GRC's Safety Chief or designee may appoint a MIT to investigate the mishap. If he or she appoints a Team, keep the mishap scene and evidence secure, and cooperate with the Team.

Investigative Procedures

The actual procedures used in a particular investigation depend on the Type (C or D), close call or results of the mishap. In general, the Appointing Officials will appoint a MIT to be in charge of the investigation and determine the mishap technique. The Appointing Official will use most of the following steps depending on the investigation:

1. Define the scope of the investigation.
2. Select the investigators.
3. Present a preliminary briefing to the investigating team, including:
    a. Description of the mishap, with damage estimates,
    b. Normal operating procedures,
    c. Maps (local and general),
    d. Location of the mishap site,
    e. List of witnesses,
    f. Events that preceded the mishap.

The MIT will do the following:

1. Visit the mishap site to get updated information.
2. Inspect the mishap site.
    a. Secure the area. Do not disturb the scene unless a hazard exists.
    b. Prepare the necessary sketches and photographs. Label each carefully and keep accurate records.

c. Interview each victim and witness. Also interview those who were present before the mishap and those who arrived at the site shortly after the mishap. Keeping accurate records of each interview.

d. Determine
    a. What was not normal before the mishap,
    b. Where the abnormality occurred.
    c. When it was first noted,
    d. How it occurred.

5. Analyze the data obtained in step 4. Repeat any of the prior steps, if necessary.
6. Determine
    a. Why the mishap occurred.
    b. A likely sequence of events and probable causes.
    c. Alternative sequences.
7. Check each sequence against the data from step 4.
8. Determine the most likely sequence of events and the most probable causes.
9. Conduct a post-investigation briefing.

10. Prepare a summary report, including the recommended actions to prevent a recurrence. Distribute the report according to applicable instructions.

An investigation is not complete until all data are analyzed and a final report is completed. In practice, the investigative work, data analysis, and report preparation proceed simultaneously over much of the time spent on the investigation.

Report of Investigation

As noted earlier, an mishap investigation is not complete until a report is prepared and submitted to proper authorities. Such reports may include a cover page, a title page, an abstract, a table of contents, a commentary or narrative portion, a discussion of probable causes, and a section on conclusions and recommendations.

The following outline has been found useful in developing the information to be included in the formal report:

1. Background Information
    a. Where and when the mishap occurred
    b. Who and what were involved
    c. Operating personnel and other witnesses
2. Account of the Mishap (What happened?)
    a. Sequence of events
    b. Extent of damage
    c. Mishap type
    d. Agency or source (of energy or hazardous material)
3. Discussion (Analysis of the Mishap - HOW; WHY)
    a. Direct causes (energy sources; hazardous materials)
    b. Indirect causes (unsafe acts and conditions)
    c. Basic causes (management policies; personal or environmental factors)
4. Recommendations (to prevent a recurrence) for immediate and long-range action to remedy:

Investigation Team Report

The findings of each mishap investigation whether by a team or a mishap investigator must be documented in a report.

a. Type C, Type D, and close call reports must be reviewed by the Chief, GSO before being released.
b. Test failures require review by the cognizant division chief prior to being released.

After the investigation has been completed and the appropriate authority has reviewed the report, the original report and all investigative findings and materials shall be released to the Chief, GSO for permanent record storage.

Release of Mishap Reports and Information

In accordance with NASA policy, witness statements given in the course of a NASA mishap investigation are considered as protected and privileged information, and therefore are non-releasable to the public or news media. NASA may also elect not to release other information in a NASA mishap investigation report depending on such factors as whether the information is classified or involves privacy considerations. Mishap Investigation members and interviewees should be made aware that the ultimate decision for the release of statements or information in a NASA mishap investigation report might reside in a court or administrative body outside of NASA's jurisdiction and control. NASA Occupational Medical Services medical reports and witness statements are not to be physically included in a Mishap Report, but should be retained in a confidential/privileged file so that inadvertent release is more effectively controlled. Public release of mishap information and mishap investigation reports is the responsibility of the Glenn Community and Media Relations Office. No information is to be released to the news media or the public from any other GRC source.

Lessons Learned

After the investigation is finalized the MIT should discuss if lessons learned report should be shared with other organizations/locations that would prevent them from having a similar mishap. If the MIT determines a lessons learned is needed it must be attached to the final mishap or close call report. For more information or assistance with the Lessons Learned Information System contact the GRC representative in the Quality Management Office (QMO) or you can go the Lessons Learned home page at htttp://llis.nasa.gov/llis/llis.html.

21A.9 TRAINING

The Center safety office shall provide the necessary training to ensure that at least one member of each investigating team has at a minimum of the following:

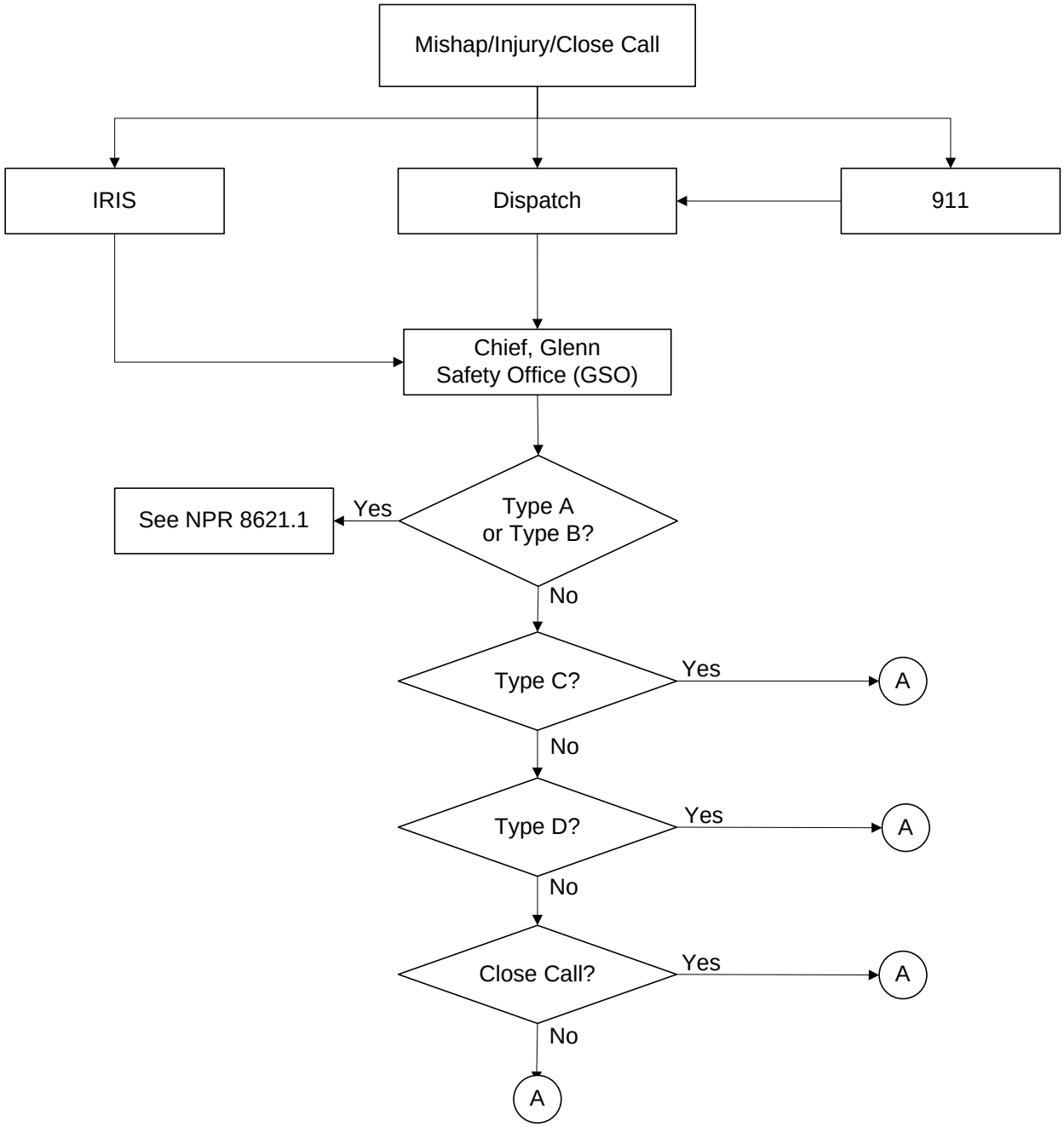
a. Knowledge of the NASA mishap investigation policy and process as demonstrated by Mishap training or on-the-job training.
b. Knowledge and skills to secure the site; preserve the mishap scene; interview witnesses; collect and impound data, records, equipment and facilities; create time lines; document facts; draw conclusions; generate recommendations; and generate mishap reports.
c. See Appendix 2.

21A.10 REFERENCES

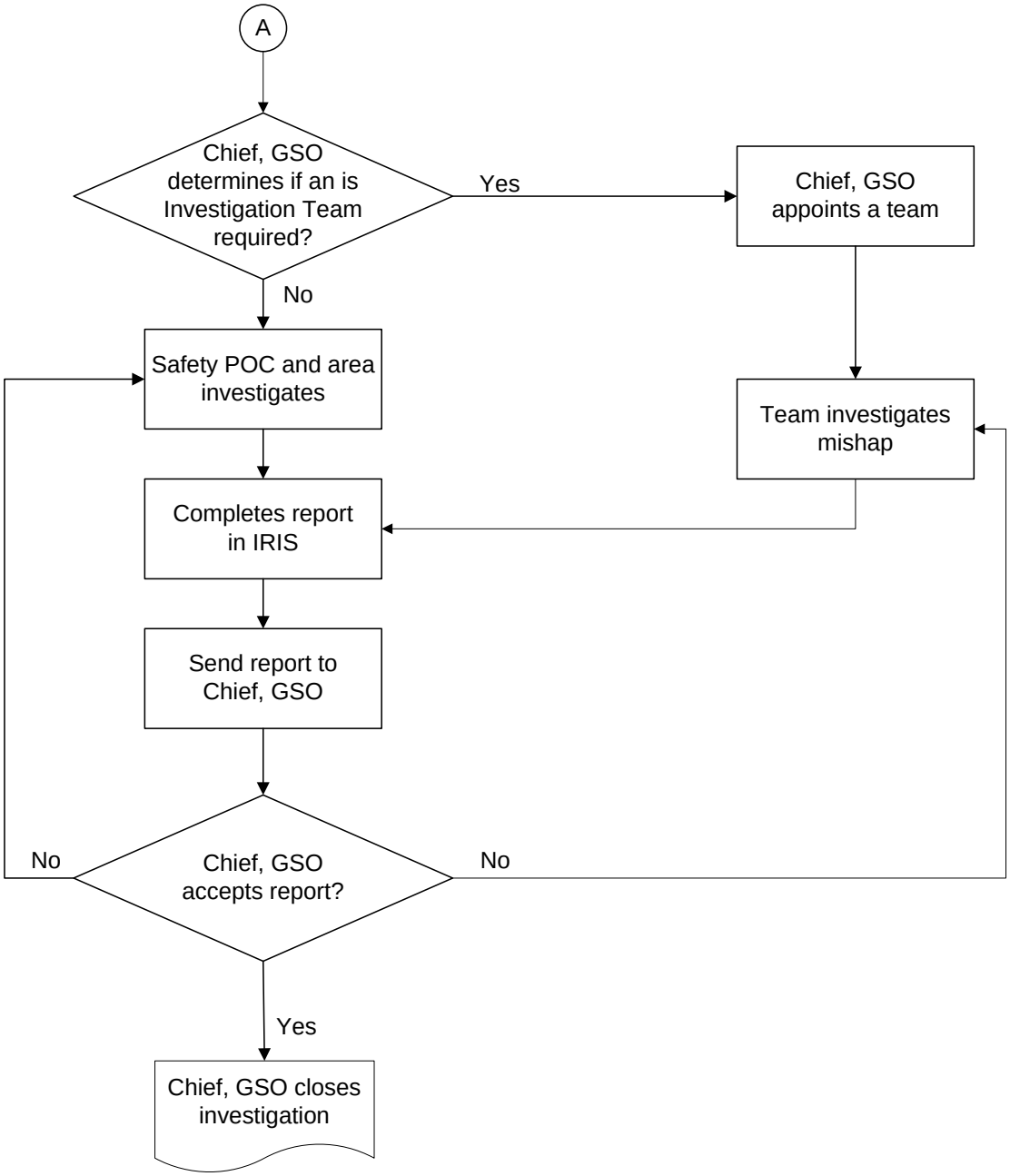
- NPR 8715.3, "NASA Safety Manual Procedures and Guidelines."
- NPR 8621. 1, "NASA Procedurals and Guidelines for Mishap Reporting, Investigating and Recordkeeping."
- Incident Reporting Information System (IRIS), NASA Incident Report Form.
- NASA Lessons Learned Information System (LLIS) at web address - http://llis.nasa.gov/llis/llis.html.

NASA Responsible Official: Manuel Dominguez
Web Curator: Deborah Ripley

APPENDIX 1 – MISHAP INVESTIGATION FLOWCHART



APPENDIX 1 – MISHAP INVESTIGATION FLOWCHART CONTINUED



APPENDIX 2 – TRAINING

Training Requirements for Mishap Investigations

	Operational Knowledge	Mishap Investigation Training/Experience	Knowledge of Analytical Techniques	Management Skills/Experience
Glenn Employee's	x			
Glenn Supervisiors	x	x		x
Building Managers	x	x		
Organization Directors	x	x	x	x
Chief Glenn Safety Office	x	x	x	x
Contractors	x			
Mishap Investigation Team (MIT)	x	x	x	x
Environomental Management Office	x	x	x	x
Glenn Safety Office	x	x	x	x